

## ROUND 12

### TOSS-UP

1) PHYSICS *Multiple Choice* After many experiments producing magnetic fields from an electric current, he turned a copper wheel so that its edge passed between the poles of a magnet and, with some other refinements:

- W) Henry thus invented the transformer
- X) Faraday thus invented the transformer
- Y) Faraday thus invented the electric generator
- Z) Henry thus invented the electric generator

ANSWER: Y) FARADAY THUS INVENTED THE ELECTRIC GENERATOR

### BONUS

1) PHYSICS *Multiple Choice* Which of the following MUST be true when comparing a photon in a vacuum having 8 electron volts and a photon in a vacuum having 4 electron volts:

- W) the 8 electron volt photon has a greater speed
- X) the 8 electron volt photon has a longer wavelength
- Y) the 4 electron volt photon has a lower frequency
- Z) the 4 electron volt photon has a lower speed

ANSWER: Y) THE 4 ELECTRON VOLT PHOTON HAS A LOWER FREQUENCY  
(Solution: A 4 eV photon has a longer wavelength than an 8 eV.  $C = \lambda \times f$ ; all travel at  $c$ .)

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### TOSS-UP

2) CHEMISTRY *Multiple Choice* Which of the following is NOT true of esters:

- W) carboxylic acid reacts with an alcohol in the presence of an acid catalyst to produce an ester
- X) an example of an ester is vitamin C
- Y) fats are esters
- Z) esters are derivatives of ammonia

ANSWER: Z) ESTERS ARE DERIVATIVES OF AMMONIA

### BONUS

2) CHEMISTRY *Short Answer* What is produced when silica, in the form of sand, is mixed with sodium carbonate and calcium carbonate, and the mixture melted and then rapidly cooled?

ANSWER: GLASS

### TOSS-UP

3) **BIOLOGY** *Multiple Choice* Which of the following instruments can separate cells according to their size and density:

- W) electron microscope
- X) electrophoretic gel
- Y) liquid chromatograph
- Z) centrifuge

ANSWER: Z) CENTRIFUGE

### BONUS

3) **BIOLOGY** *Multiple Choice* A restriction enzyme does which of the following:

- W) recognizes a specific nucleotide sequence and snips the DNA at or near this recognition site
- X) recognizes a non-specific nucleotide sequences and snips the DNA at or near this recognition site
- Y) anneals single strands of DNA
- Z) restricts which DNA strand will be transcribed

ANSWER: W) RECOGNIZES A SPECIFIC NUCLEOTIDE SEQUENCE AND SNIPS THE DNA AT OR NEAR THIS RECOGNITION SITE

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### TOSS-UP

4) **ASTRONOMY** *Short Answer* What is the term for the point in a planet's orbit where it is nearest to the Sun?

ANSWER: PERIHELION (ACCEPT: PERIAPSE) (DO NOT ACCEPT: PERIGEE)

### BONUS

4) **ASTRONOMY** *Short Answer* During a supernova, if an iron nucleus captures a neutron and undergoes beta minus decay, what element will be formed?

ANSWER: COBALT

### TOSS-UP

5) MATH *Short Answer* How many sides does a dodecagon have?

ANSWER: 12

### BONUS

5) MATH *Short Answer* A bag contains the following 12 crayons: 3 yellow, 2 blue, 6 black, and 1 red. Expressed as a fraction, what is the probability of reaching into the bag twice and pulling out a blue crayon both times, if the first crayon is not returned to the bag?

ANSWER: 1/66

(Solution:  $2/12 \times 1/11$ )

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### TOSS-UP

6) EARTH SCIENCE *Multiple Choice* Tilted layers of limestone found in the Canadian Rocky Mountains is best explained by which of the following:

- W) tilting and upheaval occurred after the limestone was deposited
- X) limestone was deposited at the angle of the tilt
- Y) oceans rose, deposited the limestone, then receded
- Z) layers were deposited by volcanic eruptions

ANSWER: W) TILTING AND UPHEAVAL OCCURRED AFTER THE LIMESTONE WAS DEPOSITED

### BONUS

6) EARTH SCIENCE *Short Answer* The progressive breaking off of icebergs from the front of a glacier that terminates in deep water is called:

ANSWER: CALVING

### TOSS-UP

7) GENERAL SCIENCE *Short Answer* What famous psychologist's theory of personality introduced the concepts of race memory and the collective unconscious?

ANSWER: CARL JUNG (ACCEPT: JUNG) (pronounced: Young)

### BONUS

7) GENERAL SCIENCE *Multiple Choice* What optical instrument is an essential tool used for a number of purposes in surveying, navigation, and meteorology:

- W) wallastone prism
- X) theodolite
- Y) immerect
- Z) two way parralax meter

ANSWER: X) THEODOLITE

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### TOSS-UP

8) GENERAL SCIENCE *Multiple Choice* A computer that delivers web pages is called a:

- W) web site
- X) web page
- Y) web server
- Z) web master

ANSWER: Y) WEB SERVER

### BONUS

8) GENERAL SCIENCE *Multiple Choice* Which is NOT an example of a record-based data model used in database development:

- W) relational model
- X) semantic data model
- Y) hierarchical model
- Z) pyramidal model

ANSWER: X) SEMANTIC DATA MODEL

### TOSS-UP

9) PHYSICS *Multiple Choice* If the velocity of a charged particle is doubled while it is moving in a circular orbit in a uniform magnetic field, what will happen to the orbital radius:

- W) it is halved
- X) it decreases by the square of the velocity
- Y) it is doubled
- Z) it remains the same

ANSWER: Y) IT IS DOUBLED

### BONUS

9) PHYSICS *Short Answer* What is the wavelength of a wave moving at 100 meters per second if its frequency is 5 Hertz ?

ANSWER: 20 METERS

(Solution:  $\lambda = \text{wave speed}/f$ ;  $100/5=20$ )

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### TOSS-UP

10) CHEMISTRY *Multiple Choice* On the periodic chart, which of the following types of elements are found in the lowest numbers:

- W) metals
- X) nonmetals
- Y) metalloids
- Z) halogens

ANSWER: Z) HALOGENS

### BONUS

10) CHEMISTRY *Short Answer* You have added 750 milliliters of water to a flask containing 250 milliliters of a 20% salt solution. What is the final salt concentration in percent?

ANSWER: 5%

(Solution: total volume =  $750 + 250 = 1000$  ml  
 $250 \text{ ml}/1000 \text{ ml} = 1:4$  or  $\frac{1}{4}$  dilution  
 $20\% \times \frac{1}{4} = 5\%$ )

### TOSS-UP

11) **BIOLOGY** *Multiple Choice* Which of the following does NOT occur in mitosis:

- W) cytokinesis
- X) sets of sister chromatids line up singly
- Y) sister chromatids separate as the centromere divides
- Z) synapses

ANSWER: Z) SYNAPSES

### BONUS

11) **BIOLOGY** *Multiple Choice* CAM plants are:

- W) a variation of C4 plants which allows them to fix carbon only at night
- X) a variation of C3 plants allowing for more efficient use of water
- Y) a type of C3 plant adapted to the tropical rain forest
- Z) a type of plant found in the Kamchaka peninsula which use hydrogen sulfide as its proton donor

ANSWER: W) A VARIATION OF C4 PLANTS WHICH ALLOWS THEM TO FIX CARBON ONLY AT NIGHT

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### TOSS-UP

12) **ASTRONOMY** *Multiple Choice* Which of the following is correct advice to give a person viewing a solar eclipse from Earth:

- W) only during totality can you safely view a solar eclipse
- X) you can safely view a solar eclipse with common mirrored sunglasses
- Y) there is no safe way to view any part of a solar eclipse
- Z) looking at an eclipse in any phase through a single lens reflex camera is safe

ANSWER: W) ONLY DURING TOTALITY CAN YOU SAFELY VIEW A SOLAR ECLIPSE

(Solution: During totality the corona is visible and has the same intensity about as the full moon)

### BONUS

12) **ASTRONOMY** *Short Answer* What is the name for a plot of the orbital speeds of stars and nebula as a function of distance from the center of the galaxy?

ANSWER: ROTATION CURVE

### TOSS-UP

13) MATH *Multiple Choice* Using an x-y coordinate axis, a parabola is given by the equation  $y = x^2$ . Give the x-y coordinates of the focus for the parabola:

- W) (0, 1/4)
- X) (1, 1/4)
- Y) (1, 1)
- Z) (2, 1/4)

ANSWER: W) (0, 1/4)

### BONUS

13) MATH *Short Answer* Express the following radical in simplified form:  $\sqrt{\frac{5}{3}}$

ANSWER:  $\frac{1}{3}\sqrt{15}$

(Solution:  $\sqrt{\frac{5}{3}} = \sqrt{\frac{5 \times 3}{3 \times 3}} = \frac{1}{3}\sqrt{15}$  )

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### TOSS-UP

14) EARTH SCIENCE *Multiple Choice* Which of the following is a limestone originating from the compacted carbonate shells of minute organisms:

- W) coal
- X) chalk
- Y) siltstone
- Z) shale

ANSWER: X) CHALK

### BONUS

14) EARTH SCIENCE *Short Answer* As glaciers erode the surface over which they move, the process by which rock fragments are loosened, picked up, and carried away by glaciers is called:

ANSWER: PLUCKING

### TOSS-UP

15) GENERAL SCIENCE *Short Answer* What is the usual name for the recent technology which is involved with the fabrication of structures measuring in the realm of molecular and atomic sizes?

ANSWER: NANOTECHNOLOGY

### BONUS

15) GENERAL SCIENCE *Short Answer* Occurring as a colorless crystalline salt or white powder, what substance, commonly sold in hardware stores and supermarkets, is used as an antiseptic, cleansing agent, water softener, corrosion inhibitor in antifreeze, in flux for silver soldering and in the manufacture of Pyrex glass?

ANSWER: BORAX (ACCEPT: SODIUM TETRABORATE DECAHYDRATE)

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### TOSS-UP

16) GENERAL SCIENCE *Multiple Choice* Starting a computer as minimalistically as possible by loading only those files and programs that are absolutely required by the operating system, is called a:

- W) cold boot
- X) warm boot
- Y) clean boot
- Z) clear boot

ANSWER: Y) CLEAN BOOT

### BONUS

16) GENERAL SCIENCE *Multiple Choice* Which of the following choices best approximates the speed at which RAM chips read information:

- W) 100 reads per second
- X) 1000 reads per second
- Y) 1 million reads per second
- Z) 100 million reads per second

ANSWER: Z) 100 MILLION READS PER SECOND

### TOSS-UP

17) PHYSICS *Multiple Choice* Which of the following is the correct representation of the capacitance of a parallel plate capacitor where C is capacitance, Q is charge, and V is voltage across the capacitor:

- W)  $C = Q/V$
- X)  $C = V/Q$
- Y)  $C = Q \times V$
- Z)  $C = V + Q$

ANSWER: W)  $C = Q/V$

### BONUS

17) PHYSICS *Multiple Choice* Which of the following materials does NOT polarize light:

- W) an Argentinum prism
- X) crystals of calcite cut with a 68 degree angle cleaved along the optic axis and bound together with Canada balsam
- Y) reflection of unpolarized light from an insulator
- Z) a Nicol (pronounced: Ny-call) prism

ANSWER: W) AN ARGENTUM PRISM

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### TOSS-UP

18) CHEMISTRY *Multiple Choice* A bond that results from the overlap between two p orbitals oriented perpendicularly to the inter-nuclear axis is called a:

- W) sigma bond
- X) pi (pronounced: PIE) bond
- Y) delta bond
- Z) kappa bond

ANSWER: X) PI BOND

### BONUS

18) CHEMISTRY *Short Answer* A sample of gas at 760 torr has a volume 10 liters at a temperature of 27 °C. Rounded off to the nearest whole integer, if the temperature is increased to 127°C at the same pressure of 760 torr, what is the new volume?

ANSWER: 13 LITERS

(Solution:  $V_f = (V_i)(\text{temperature factor})$ ;  $V_f = (10 \text{ L})(400 \text{ K}/300 \text{ K}) = 13.3 \text{ L}$ )

### TOSS-UP

19) BIOLOGY *Multiple Choice* A cell placed in an isotonic solution will:

- W) swell
- X) shrink
- Y) crenate
- Z) remain the same

ANSWER: Z) REMAIN THE SAME

### BONUS

19) BIOLOGY *Multiple Choice* The net products of glycolysis are:

- W) 2 FADH, 2 ATP, pyruvate, and 2 H<sub>2</sub>O
- X) 2 FADH, 2 ATP, and acetyl Co-enzyme A
- Y) 2 NADH, 2 ATP, pyruvate, and 2 H<sub>2</sub>O
- Z) 2 FADH, 1 ATP, and 2 NADH

ANSWER: Y) 2 NADH, 2 ATP, PYRUVATE, AND 2 H<sub>2</sub>O

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### TOSS-UP

20) MATH *Multiple Choice* The population of a nearby town was 10,000 in January 2000. It is estimated that the population will increase by 10% each year. What will the population of the town be in January 2002:

- W) 12,000
- X) 12,100
- Y) 12,200
- Z) 12,220

ANSWER: X) 12,100

### BONUS

20) Math *Short Answer* Factor the following equation:  $x^2 - 6x + 5 = 0$

ANSWER:  $(x - 5)(x - 1) = 0$

### TOSS-UP

21) EARTH SCIENCE *Multiple Choice* Which of the following is a sedimentary rock that results from evaporation and precipitation of sea water:

- W) gypsum
- X) chalk
- Y) shale
- Z) granite

ANSWER: W) GYPSUM

### BONUS

21) EARTH SCIENCE *Short Answer* What is another name for extinct lakes, such as the basin that is now Death Valley:

ANSWER: PLUVIAL LAKES

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### TOSS-UP

22) GENERAL SCIENCE *Multiple choice* The total dissolved inorganic carbon in the oceans is:

- W) about 1/100 the total dissolved inorganic carbon in the atmosphere
- X) about 1/10 the total dissolved inorganic carbon in the atmosphere
- Y) about equal to the total dissolved inorganic carbon in the atmosphere
- Z) about 50 times the total dissolved inorganic carbon in the atmosphere

ANSWER: Z) ABOUT 50 TIMES THE TOTAL DISSOLVED INORGANIC CARBON IN THE ATMOSPHERE

### BONUS

22) GENERAL SCIENCE *Short Answer* What class of drugs, which is most commonly used for urinary tract infections, works by inhibiting the action of para-aminobenzoic acid, a substance needed by bacteria to grow?

ANSWER : SULFA DRUGS

### TOSS-UP

23) PHYSICS *Multiple Choice* When an airplane's ailerons move in opposite directions they usually cause a plane to:

- W) pitch
- X) yaw
- Y) roll
- Z) stall

ANSWER: Y) ROLL

### BONUS

23) PHYSICS *Short Answer* In pursuit of an insect, a lizard, braced against a rock, accelerates with a horizontal magnitude of 15 meters per second squared. How much horizontal force, in newtons, must the lizard exert on the rock to produce this acceleration if it weighs 3 kilograms?

ANSWER: 45 NEWTONS (ACCEPT: 45)

(Solution:  $F=MA$ ;  $F=3 \times 15$ ;  $F=45$ )

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### TOSS-UP

24) CHEMISTRY *Multiple Choice* An element that can exist in several natural forms, such as coal versus diamonds, are typically referred to as:

- W) morphotropes
- X) heliotropes
- Y) isotopes
- Z) allotropes

ANSWER: Z) ALLOTROPES

### BONUS

24) CHEMISTRY *Short Answer* What is the characteristic geometrical arrangement in a molecule that has a hybrid orbital set of three identical  $sp^2$  (pronounced: S, P, 2) orbitals?

ANSWER: TRIGONAL PLANAR

**TOSS-UP**

25) BIOLOGY *Multiple Choice* PCR does NOT use which of the following:

- W) heat to separate strands
- X) primers
- Y) DNA polymerase
- Z) reverse transcriptase

ANSWER: Z) REVERSE TRANSCRIPTASE

**BONUS**

25) BIOLOGY *Short Answer* B cells get their name from what part of a bird's body?

ANSWER: BURSA FABRICUS